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REMARKS

The Applicants sincerely thank the Examiner for withdrawing the objection to the specification, and for withdrawing all prior art combination references based upon U.S. Patent No. 5,343,542.

Claims 3, 7, 8 and 26-29 are amended and claims 1, 2, 6, 9 and 10 are canceled. Claims 17-25 were previously cancelled. After entry of this amendment, claims 3-5, 7, 8, 11-16 and 26-31 will be pending.

Claims 3, 7, and 8 are amended to depend from claim 11. Claim 26 is amended to recite thermal stability of less than or equal to 50 parts per million per degree Centigrade, as in original claim 6, and a spectrometer resolution greater (*i.e.* better) than a nominal resolution of the detector, as discussed on page 10, lines 25-31 of the written description and claimed in original claim 17 (previously canceled in response to a restriction requirement). Claim 26 is also amended to correct a grammatical error. Claim 27 is amended to recite a spectrometer resolution greater (*i.e.* better) than a nominal resolution of the detector, as discussed on page 10, lines 25-31 of the written description and claimed in original claim 17 (previously canceled), and to improve the form of the claim. Claims 28 and 29 are amended to more particularly point out the invention and to improve the form of the claims. Support for these amendments is found in the written description on page 11, lines 30-33. Thus, the undersigned believes these amendments do not add new matter.

Rejections under 35 U.S.C. § 103

Claims 1 and 9 are rejected as being unpatentable over U.S. Patent No. 6,151,114 by Russell (hereinafter "Russell") in view of U.S. Patent No. 6,130,971 by Cao (hereinafter "Cao"). Claims 1 and 9 have been canceled, rendering these rejections moot.

Claim 11 stands rejected as being unpatentable over Russell in view of Cao, and in further view of U.S. Patent No. 5,166,755 by Gat (hereinafter "Gat"), and in yet further view of U.S. Patent No. 6,278,549 by Gaebe (hereinafter "Gaebe"). The Examiner states that Russell discloses a linear variable bandpass filter wherein the incident light is collimated, that Cao discloses the use of a fiber optic input mated with collimating optics, that Gat discloses the user of magnification optics for attaining proper beam size for illumination of a linear variable spectrometer, and that Gaebe discloses an etalon filter that has a thermal stability less than 50 parts per million per

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degree Centigrade. The Examiner further states that it would have been obvious to combine the various elements of the four references to arrive at the claimed invention, and in particular that it would have been obvious to design the filter to have the recited thermal stability so that less maintenance, as well as fewer parts are needed. The Applicants respectfully traverse the Examiner's position.

Russell does not disclose or suggest an optical spectrometer. The etalon structure of Russell is used as an interference element ("wedge etalon") 18 to create fringe patterns when illuminated with coherent radiation. The interference element 18 acts as a coherence filter to reveal the presence of long coherence length energy (Col. 6, lines 7-11). Russell also states that the interference element format provides tolerance for thermal variations, wavelength differences, and a broad range of arrival angles by providing a plurality of preferably several, spatially diverse areas of constructive interference (Col. 6, lines 15-19).

The interference element 18 disclosed in Russell operates differently from the linear variable bandpass filter recited in claim 11. The coherent laser warning system of Russell operates by detecting fringes of incident coherent (laser) radiation with a detector 12. It is generally desirable that the interference element 18 used in such a detector 12 have a relatively broad wavelength response so that the desired constructive interference can occur, preferably at several locations along the length of the interference element 18. Accordingly, the partially reflective top and bottom surfaces 20, 22 were fabricated by depositing pure aluminum to a thickness of about 40 nanometers to obtain a reflectivity of about 75%. Col. 5, lines 5. The broadband reflectivity of these aluminum reflectors would be undesirable in a linear variable bandpass filter used in an optical spectrometer element because the interference element would not be likely to provide the desired discrimination. Thus, the interference structure 18 disclosed in Russell is not equivalent to the linear variable bandpass filter recited in claim 11.

Furthermore, the radiant energy 10 disclosed in Russell does not appear to be collimated light. To the contrary, it appears advantageous that the detector 12 of Russell be able to detect laser threats over a broad range of acceptance angles (*see* Figs. 14, 15 and associated text, Col. 5, lines 27-28, and Col. 6, line 17). It is also respectfully noted that the detector 12 appears to receive the radiant energy 10 without an intervening fiber optic cable. The Applicants respectfully submit that modifying the coherent laser warning system as suggested by the Examiner would change a fundamental operating characteristic of the system, and that Russell

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teaches away from the present invention because of the desirability of detecting the angle of approach of the coherent radiation.

Finally, Russell states that the interference element format provides tolerance for thermal variations. It appears that, over normal operating conditions, the coherent laser warning system disclosed in Russell can detect the interference fringes even though the physical location of the fringe pattern on the detector array 30 may shift due to temperature or other factors. There is no suggestion in Russell to provide a thermal stability of 50 parts per million per degree Centigrade of ambient temperature for the interference element 18. Considering the claimed invention as a whole, and the coherent laser warning system of Russell as a whole, and that there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the coherent laser warning system or to combine reference teachings to obtain the claimed optical spectrometer component, the Applicants respectfully assert that no prima facie case of obviousness has been made.

Similarly, even if it were desirable to provide thermal stability for interference elements in the cited references, there is no suggestion to provide thermal stability in the manner taught by the Applicants. The Applicants realized that a sufficiently stable linear variable filter could provide a nominal resolution of 3 Angstroms (Page 9, line 1). Prior art optical wavelength sensors often used thermal control or data processing techniques (*see, e.g.* PCT/GB95/00094, page 6, lines 15-27) to compensate for temperature-related wavelength shifts. However, it is not clear that these prior art techniques, which teach away from the present invention, would provide a reasonable expectation of success for thermal stability of the optical spectrometer component of claim 11.

The Examiner has not provided a convincing line of reasoning that fabricating the tapered interference element of Russell on the quartz substrate of Gaebe would have a reasonable expectation of success or result in the claimed invention. The optical filter having a quartz substrate described in Gaebe appears to be directed at an optical filter with a spacer layer 125 having a constant thickness. Gaebe states that other film thicknesses may require different quartz substrate thicknesses to compensate for temperature-related shifts in the center wavelength. It appears unlikely that the tapered interference element of Russell could achieve the recited thermal stability by modification according to the disclosure of Gaebe. Thus, the combination of Russell and Gaebe would not result in the optical spectrometer component of claim 11. Accordingly, the Applicants believe claim 11 is not disclosed or suggested by the cited references, and that claim

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11 and all claims that depend from claim 11 are patentable.

Claim 13 recites a linear variable bandpass filter with a 50% bandwidth of less than or equal to about 0.6 nm at a center wavelength between about 1530-1600 nm. The Applicants respectfully submit that the Examiner has not provided a convincing line of reasoning as to how an interference element 18 with such a narrow bandwidth could be used in the coherent laser warning system disclosed in Russell in a fashion having a reasonable expectation of success. The Applicants believe that a linear variable bandpass filter with such a narrow bandwidth would be undesirable for producing the constructive interference that the coherent laser warning system operates on. Therefore, the Applicants believe claim 13 is further patentable.

The Applicants also believe that claim 14 and all claims that depend from claim 14 are allowable for at least the reasons provided above in support of claims 11 and 13.

Claim 26 stands rejected as being unpatentable over Russell in view of Cao, Gat, Gaebe, and Takashashi (*Applied Optics*, vol. 34, No. 4, pp. 667-75). The Examiner states that Cao discloses optical fiber inputs that handle optical information with channel spacing far smaller than 200 GHz, and asserts that a linear variable filter with Russell's taper direction length and all of the prior art structure can spectrally resolve such an optical data stream. The Applicants respectfully traverse the Examiner's position.

Claim 26, as amended, recites, among other elements, a linear variable filter with a thermal stability of less than 50 parts per million per degree Centigrade. Similar to Russell, Cao discloses an interferometer 490A, 800 (see Figs. 7, 8 and associated description) and not an optical spectrometer. As with the interference element disclosed in Russell, this interferometer is not equivalent to the recited linear variable filter. Although Cao states that the interferometer illustrated in Fig. 7 is temperature sensitive, Cao provides a solution in Fig. 8 (Col. 5, lines 7-26), and thus teaches away from the present invention.

Furthermore, amended claim 26 recites, among other elements, that the detector array provides a nominal resolution, and a memory with a calibration array that provides a spectrometer resolution greater than the nominal resolution. As discussed on page 11, line 13-15, it was only after realizing that a suitably stable filter that is truly continuous could be fabricated that the inventors attempted to build an optical spectrometer according to the present invention. It was previously believed by the inventors that an optical spectrometer based on a linear variable filter could not achieve resolution better than 8 Angstroms because thermal and aging drift would

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quickly invalidat the calibration data, requiring frequent re-calibration, and that a calibration for a linear variable filter spectrometer uses many closely spaced signals, unlike the relatively simple calibration of a diffraction grating-based spectrometer (Page 11, lines 3-12). Once the inventors convinced themselves that a suitably stable linear variable filter could be produced, they realized that the combination of the highly stable linear variable filter with a calibration array having more calibration wavelengths than detectors in the array could achieve a spectrometer resolution greater than the nominal resolution of the detector array. No combination of the cited art discloses or suggests claim 26, provides any reasonable expectation of success for claim 26, or provides the required motivation to result in claim 26. Therefore, the Applicants believe claim 26 is allowable.

Claim 27 is believed to be allowable for at least the reasons given above in support of claim 26, and that claim 28 is further allowable for the reasons given below in support of claim 29.

Regarding claim 29, the Examiner states that Russell discloses a tapered linear variable bandpass filter and cites Gaebe for disclosing that the judicious selection of materials and film thicknesses allows a more narrow bandwidth. However, Gaebe appears to be discussing band-pass filters in Col.1, lines 35-40. Claim 29, as amended, recites, among other elements, a variable edge filter (*i.e.* variable long-pass or short-pass filter) (*see* Page 11, lines 30-33). As discussed on page 11, the inventors initially believed that a variable bandpass filter was necessary to build an optical spectrometer, but realized that a variable edge filter could be used as well. On page 12 the inventors teach how a linear variable edge filter is used in an optical spectrometer. The combination of references cited by the Examiner does not disclose or suggest using a variable edge filter in an optical spectrometer and the Applicants believe claim 29 is allowable.

Claim 30 stands rejected as being unpatentable in view of Russell in combination with Cao and Gaebe. The Examiner cites Gaebe for disclosing an etalon filter with a thermal stability less than 50 parts per million per degree Centigrade, and for having a FWHM of less than or equal to about 0.6 nm around a center wavelength within the optical communication band. However, the optical filter having a quartz substrate described in Gaebe appears to be directed at an optical filter with a spacer layer 125 having a constant thickness. Gaebe states that other film thicknesses may require different quartz substrate thicknesses to compensate for temperature-related shifts in the center wavelength. It appears unlikely that the interference element 18 of Russell could be modified by the disclosure of Gaebe to result in the optical spectrometer of claim 30. Similarly,

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the Examiner has not provided a convincing line of reasoning that such modification would have a reasonable expectation of success. Thus, the Applicants believe claim 30 is patentable.

CONCLUSION

The Applicant submits that all claims are now in condition for allowance. Favorable reconsideration and timely issuance of a Notice of Allowance are respectfully requested. Should the Examiner consider necessary or desirable any formal changes anywhere in the specification, claims and/or drawings, then it is respectfully asked that such changes be made by Examiner's Amendment if the Examiner feels this would facilitate passage of the case to issuance. If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at (707) 591-0789.

Respectfully Submitted



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